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Impact of the KWL on the Acquisition of Scientific Concepts in Science among the Third Grade Students in the Directorate of Education of Irbid

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Abstract: The study aimed to identify the impact of the Know, Want to know and Learn (KWL) strategy on the acquisition of scientific concepts in science among the third grade students in the directorate of education of Irbid. The semi-experimental method was adopted and the study sample consisted of (60) male and female students from the third grade from Irbid's schools; they were distributed into two groups: control group consisting of (15) male students and (15) female students and experimental group consisting of 15 male students and 15 female students. The results showed statistically significant differences for the variable of the group in the post-test in favor of the experimental group, whose members were taught through using the (K.W.L), statistically significant differences for the variable of gender in favor of the females and no statistically significant differences in the post-test. The researcher recommended adopting a teaching method through using the cognitive maps in teaching science due to their impact on acquiring the scientific concepts.

Keywords: cognitive maps, scientific concepts

INTRODUCTION

Donna Ogle invented this strategy in 1986 at the National School of Education in Evanston, America in a graduation project on reading and language arts; she developed it to reach the case it is now. Under this model, there is a development of the active reading of the interpreted texts to help learners activate and apply their prior knowledge to understand the text and employ it in a method that suits the learner's cognitive structure, which is one of the strategies of reading comprehension [1].

The Know, Want to know and Learn (K.W.L) strategy has a great importance in teaching by raising the thinking of students as the process of asking questions and independent thinking since it trains them on setting objectives for the program from its steps (what I know about the topic, what I want to know about the topic, and what I learned about the topic). Such steps work on providing a comprehensive, meaningful and subjective understanding from the student himself to the topic [2]. This study is important as it activates the prior knowledge of students and makes it a starting point for linking it with the new information so there would be a meaning to education [3].

Al-Alyan [4] emphasizes the importance of this strategy by saying "this strategy is very useful because it enables students to participate with each other, exchange information they know about the topic, and set their learning goals, thereby enhancing their understanding and comprehension."

Abu Sultan [5] indicates that in this strategy the teacher asks the learner for three sets of things:

- Determining what he already knows; this group is symbolized by the letter (K) which means (What I KNOW?)
- Determining what he needs to know; this group is symbolized by the letter (W), which means (What I Want to Know?).
- The learner is asked to determine what he already knew; this group is symbolized by the letter (L) which stands for (What I learned).

Kopp [6] defined it as a good strategy used by teachers to stimulate the students' thinking on the topic of the lesson before new learning takes place.

Al-Burkani [7] defined it as an organized and ordered set of steps and procedures which are listed in the teacher's guide; it requires that the teacher implements activities, and uses the methods, means, and

various evaluation methods, which contribute to organizing and summarizing thinking in three columns that require answering three questions on the learner's knowledge about the topic, what he would learn and what he learned on the topic of the study, which leads to ordering ideas and legalizing the learner's effort in study and research.

Atiyah and Saleh [8] defined it as one of the strategies of structural learning, where the student records all his prior information on the topic, then decides and records his needs in the light of the information provided by the teacher, records what he has already learned, and then records the most important applications for what he has learned, which can be done individually or collectively in groups organized by the teacher as required by the situation.

Bahlul [9] stated that through the K.W.L strategy, the lesson goes through the following steps:

- The teacher draws the (K.W.L) chart on the blackboard to remind students of this strategy; then students write the information they already knew as well as the new information they want to know before studying the topic and then complete the chart with the new information and knowledge they learned after studying the topic.
- The teacher makes his students as one unit in their classroom or he might divide them into small groups summarizing their prior knowledge on the topic matter; then, the teacher writes each idea in a chart or makes the students write it.
- The teacher asks the students to ask questions to be answered during their study of the topic and then he writes these questions in the chart.
- The teacher asks the students to read the topic of the lesson and write their observations on the knowledge and experience they have learned confirming the new information that is linked to the question: what do I need to know?
- The teacher asks all or some students to volunteer to write the knowledge and experience they have learned through studying the topic to complete the chart; he discusses this new information with them noting any unanswered questions.

Al-Fahmi [10] has identified the role of the teacher in this strategy as follows:

- Identifying the objectives of the lesson according to the lesson texts.
- Activating students' prior knowledge as a starting point for learning.
- Providing appropriate classroom circumstances and managing discussion groups.
- Directing and organizing students' knowledge using the strategy outline.
- The axes and the generator of questions which increases students' thinking.

- Providing the feedback to students to benefit from their learning.
- Evaluating the performance of students and the extent to which they have achieved the desired learning.

Al- Khafigi [11] also determines the role of the student in the K.W.L strategy as follows:

- Determines his prior knowledge on the topic.
- Practices the independent thinking on the issues, and ideas around which the topic revolves.
- Raises questions that meet his knowledge needs that are based on his prior knowledge.
- Classifies the ideas contained in the topic into main ideas and sub ideas.
- Practicing cooperative thinking with other students in the classroom.
- Discusses and clarifies the accuracy of the information.
- Corrects the inaccurate information and facts in his prior knowledge.

Study Problem and Questions

Hattab [12] states that one of the problems that confuses the teaching of scientific concepts lies in including many concepts in the textbooks that exceed the students' ability of understanding; Zaytoun [13] determines the sources and difficulties of forming and preparing the concepts that they mostly result from external factors represented in inappropriate curricula that do not take into account students' needs and interests, and the ordinary teaching strategies and methods used by teachers in their teaching. This might be attributed to the strategies followed by the teacher in the traditional teaching process, which makes science learning a difficult and undesirable process for students; therefore, students seek memorization only to pass the school tests making them unable to think and solve the problems they face. Accordingly, it was important to search for strategies that help explain the concepts such as the (K.W.L). From the above, the main purpose of this study is identifying the impact of the (K.W.L) on the acquisition of the scientific concepts in sciences among the third-grade students in the directorate of education of Irbid. The study is conducted to identify the impact of the (K.W.L) on the acquisition of scientific concepts in the science textbook among students. The study problem is to answer the following questions:

- What is the impact of the (K.W.L) on the acquisition of the scientific concepts in science among the third grade students in the directorate of education of Irbid?
- Are there statistically significant differences in the impact of the (K.W.L) on the acquisition of the scientific concepts in science among the third-grade students in the directorate of education of Irbid due to the variable of gender (males, females)?

STUDY OBJECTIVES

The study aims to identify the impact of the (K.W.L) on the acquisition of the scientific concepts in science among the third-grade students in the directorate of education of Irbid, and verify the difference in their acquisition of the scientific concepts according to gender (males, females).

Study Importance

The study's importance comes from the importance of the topic in introducing the (K.W.L) in teaching and equipping teachers with the skills needed for using the (K.W.L) in teaching the scientific concepts. It is hoped that the study's results would contribute to encouraging teachers towards employing it in a way that makes it easier for students to remember, keep and use the information and experience in similar circumstances. According to the knowledge of the researcher, there are few studies on using the (K.W.L) strategy in teaching the scientific concepts; therefore, this study seeks to overcome this deficiency and include the cognitive maps in science in accordance to the educational development plans which would benefit the developers of the curricula.

Study Limitations

Temporal limitations: This study was applied in the first semester of the academic year 2017-2018.

Spatial limitations: This study was applied in Al-Shifa'a Bent Ouf Schools for boys and girls in the directorate of education of Irbid.

Objectivelimitations: This study was limited to studying the impact of the (K.W.L) strategy on acquiring scientific concepts.

Study Terminology

Know, Want to know and learn (K.W.L): One of the meta-cognition strategies, which depends on activating the prior knowledge and making it the basis of the new knowledge [14].

-procedurally, it is defined as an educational strategy based on asking questions on the information of the learner and to what he should reach for stimulating thinking before, during and after various academic and cognitive activities.

Scientific concepts: procedurally, the scientific concept is a name, word or symbol that is given to abstract key ideas that reflect the common characteristics of a set of attitudes and things taught by the third-grade students through using the (K.W.L).

The third grade: one of the primary grades of the basic stage of public education, which starts from the first grade to the third grade with students whose age ranges (6-9) years old.

Prior Studies

A group of studies examined the (K.W.L); Al-Sharari [15] conducted a study that aimed at identifying the impact of the (K.W.L) and the cognitive maps on the acquisition of scientific concepts among the sixth grade students in Jordan. To achieve the objective of the study, the researcher prepared a test to measure the scientific concepts. The researcher adopted the quasi-experimental approach where the first experimental group consisting of 30 students was taught through the (K.W.L), the second experimental group consisting of 30 students was taught through the cognitive maps' strategy and the control group consisting of 30 students was taught in the traditional , regular method. The test was applied to the three groups before and after teaching. The results of ANCOVA analysis showed a statistically significant difference between the groups due to the (K.W.L) and the cognitive maps in the acquisition of the scientific concepts in favor of the two experimental groups.

Abu Aloosh [16] aimed at identifying the impact of the (K.W.L) strategy on the acquisition of scientific concepts and attitudes among the eighth grade students in science in Jordan compared to the regular method. To achieve the objectives of the study, the quasi-experimental approach was used in addition to the test of acquiring the scientific concepts and attitudes. The study sample consisted of 60 eighth grade students in Hartha secondary school in BaniKinana directorate of education; the study sections were randomly divided into two groups: experimental group consisting of 31 students, which were taught through using the (K.W.L) strategy and the control group consisting of (29) students, which were taught through the regular method. The results of the study showed statistically significant differences between the mean grades of the experimental group and the control group in the test of acquiring the concepts in addition to the scale of the scientific attitudes among the eighth-grade students due to the teaching strategy, for the benefit of the experimental group, differences due to the prior scientific achievement in favor of the students with high achievement in the test of acquiring the scientific concepts in favor of the students with medium achievement according to the scale of the scientific attitudes, and finally no statistically significant differences among the mean grades of the experimental group and the control group in the test of acquiring the concepts and the scale of the scientific attitudes attributed to the interaction between the teaching strategy and the level of the educational achievement.

Al- Khafaji [17] aimed to identify the impact of using the K.W.L chart on the achievement in science by the students of the fifth grade. The researcher adopted the experimental design with two groups (an experimental group with 27 students and a control group with 28 students of the fifth grade from Al-Abra primary school for boys in the first Karkh/Bagdad

directorate of education. As for the study tool, the researcher prepared an objective achievement test in science that consisted of 40 multiple-choice items. The study resulted in the fact that the experimental group, which adopted the (K.W.L) chart, exceeded the control group which adopted the regular method in teaching in addition to the fact that the experimental group exceeded the control group in terms of detention.

Tok [18] carried out a study on identifying the effects of the (K.W.L) strategy and the note-taking strategy on the academic achievement of students and their attitudes towards the science and technology courses. The study adopted the quasi-experimental approach. As for the study sample, it consisted of 121 students from the fifth grade in the public schools of Hatai province, Turkey and the sample was divided into two experimental groups: the first experimental group which adopted the (K.W.L) strategy and the second experimental group, which adopted the note-taking strategy in addition to the control group which adopted the regular method. The results of the study concluded that there is effectiveness for using the (K.W.L) and the note-taking strategy on developing the educational achievement and the attitude towards science and technology course.

Al-Salim [19] aimed to identify the impact of using the K.W.L.H strategy and the goal-orientation program on developing the meta-cognition among the third grade students in science in light of the teaching theory based on the mind and the theory of the goal-orientation. The researcher adopted the experimental approach with one control group and two experimental groups. The research sample consisted of three sections randomly selected; there were (15-27) female students in each class and the research sample was divided into three groups: one control group consisting of 15 female students, and two experimental groups: the first consisted of 15 female students adopting the k.W.L.H and the second consisting of 15 female students adopting the goal-orientation program. The study tools consisted of meta-cognition test and the goal-orientation program test. The results of the study found statistically significant differences between the control group, the first experimental group (1) and the second experimental group (2) in the post scales of the research variables in favor of the two experimental groups.

Ramadan [20] aimed to identify the effectiveness of the K.W.L strategy in developing the

scientific concepts and the critical thinking skills in science for the first primary grade. The study was limited to a sample of the first primary students at Nasr School in two groups: experimental group with (46) female student and control group with 46 female students. The researcher adopted a test of scientific concepts, a critical thinking test and a scale of the level of information processing. The results of the study showed statistically significant differences in the development of scientific concepts in favor of the experimental group, which adopted the K.W.L strategy and a lack of interaction between the K.W.L, the regular strategy and the level of processing.

Comment on Prior Studies

Through reviewing the prior studies, it was noted that there were studies on the (K.W.L) and other studies on the scientific concepts in science, such as [19, 15, 16]. We noted that all these studies had used the test as a tool to identify their variables. The studies were conducted in many countries that [15] was conducted in Jordan [17], in Iraq and [18] in Turkey. The prior studies were used in the theoretical literature as well as in examining the results of the studies and presenting them to the teachers in the field so they can examine, apply and practice such results.

STUDY METHODOLOGY

The researcher adopted the quasi-experimental approach, which examined the differences between the two samples in reality without controlling the other variables to identify the impact of the (K.W.L) on the acquisition of the scientific concepts in the science textbook of the third-grade students in Irbid's directorate of education.

Study Community and Sample

The study community consisted of (2344) male and female students of the third grade in Irbid's directorate of education and the study sample consisted of (60) male and female students who were randomly selected; the members of the study sample were randomly divided into two groups: control (15) males and (15) females and an experimental group that consisted of (15) males and (15) females. The students of the experimental group studied the scientific concepts through using the (K.W.L), while the students of the control group studied the concepts through the traditional method. Table 1 shows the method of the distribution of the members of the study sample according to its variables:

Table-1: Distribution of sample members according to the variables of (gender and group)

variables	level	Frequency	percent
Gender	Male	30	50%
	Female	30	50%
	Total	60	100%
Group	Experimental	30	50%
	Control	30	50%
	Total	60	100%

Study Tools

First: educational material using the cognitive maps

The unit was selected from the science textbook of the third grade in Jordan; the researcher analyzed the lessons and identified the educational objectives to be achieved. After reviewing the prior literature and prior studies, the researcher identified the scientific concepts contained in these lessons and prepared the (K.W.L) teaching strategy. To ensure the validity and proper design of these maps and their valid information, the researcher presented them to a group of nine referees with competence and experience in the educational science and teaching methods, whose observations and suggestions were examined and modified.

Second: Testing Scientific Concepts

In order to achieve the objectives of the study, the researcher prepared the test of the scientific concepts for the third grade science textbook, which is taught in Jordan, where the test was prepared using the science textbook in addition to the teacher's guide; the content of the study material was analyzed and a specification chart was prepared for the scientific concepts found in this unit. In light of this, the items of the test of the scientific concepts were prepared consisting of (20) multiple-choice items. The test was prepared according to the following steps:

- Determining the purpose of the test, which is measuring the achievement of students in the eighth grade in terms of the scientific concepts included in science.
- Determining the general objectives of the unit and the specific behavioral objectives according to Blum classification (remembering, understanding, applying, analyzing, composing and evaluating).
- The content of the teaching material was analyzed from the content of the science textbook of the

third grade which was later divided into major themes and sub-themes.

- Preparing the specification chart for the test to determine the number of items needed for each goal level and topic.
- Writing the items of the achievement test according to the specification chart, determining the grades on items and the total mark, determining the test time and presenting it in its initial form.

Test Validity

The test in its initial form was presented to a group of experienced referees in the field of scale, evaluation and science teaching methods to get their opinion on the language of the items, the appropriateness of the test items for the purpose of the test, and the suitability of the items with the levels of the objectives; their opinions and suggestions were taken and all the necessary deletions and modifications were conducted. The researcher relied on (80%) as an agreement rate among the referees on the item appropriateness.

To determine the consistency between the test items and the test as a whole, the test will be applied to a survey sample of (20) male and female students from outside the study sample, where the correlation coefficients between each item and the test as a whole will be calculated using Pearson correlation coefficient, which should be positive, not less than 0.30 and statistically significant so that the test enjoys a degree of validity.

To confirm the significance of the structural validity of the test, the researcher applied the test on a survey sample of (20) male and female students outside the study sample and from the community itself to ascertain the consistency between the test items and the test as a whole; table-2 illustrates this.

Table-2: Structural Validity Coefficients (correlation between each item and the test as a whole)

Number	correlation between each item and the test as a whole	Number	correlation between each item and the test as a whole
1	.826	10	.695
2	.826	11	.975
3	.975	12	.575
4	.799	13	.603
5	.799	14	.534
6	.371	15	.671
7	.671	16	.975
8	.432	17	.743
9	.772	18	.649
19	.671	20	.799

Table-2 shows that all the correlation coefficients between the test items and the test as a whole ranged between (0.371-0.975). This is an indication of the correlation between the items and the test as a whole, which are significant correlation

coefficients that are acceptable for the purposes of this study.

The researcher applied the reliability steps on a sample of 20 male and female students from outside the

study sample by finding the Cronbach alpha coefficient for the questionnaire that amounted to (0.945), which is high and shows the reliability of the study tool.

Test Scoring

The final form of the test consisted of (20) multiple choice items where each item has four alternatives, three wrong alternatives, and one valid alternative; the correct answer to the item is given one degree, and zero if the student gives the wrong answer making the total degree of the test (20).

Procedures of Applying the Study

In order to achieve the objectives of the study, the researcher followed the following steps:

- Reviewing the theoretical literature and prior studies and identifying the study problem and questions.
- Determining the study community and sample.
- Preparing the educational material for the conceptual maps and ascertaining its validity.
- Preparing an achievement test to measure the extent of acquiring the scientific concepts among the third-grade students in Jordan and asserting its validity and reliability.
- Application of the study. First, the members of the control group and the members of the experimental group in the random method and asserting the equivalence of the two groups through conducting a pre-test; the researcher supervised, trained and directed the science teachers in the schools of the study sample to apply this study; the male and

female students of the experimental group were taught according to the K.W.L while the students of the control group were taught according to the traditional method through using the science textbook, which was taught in Jordan for the academic year 2017/2018.

- After the application process, a post-test was conducted for the control and experimental groups, which was scored and grades were collected and statistically processed to answer the study questions, reach to results and propose recommendations.

Statistical Processing

The following statistical methods were used using the SPSS:

- (Two-way ANOVA) to verify the equivalence of the control and experimental groups.
- Arithmetic means and standard deviations of the pre and post tests according to the variables of group and gender.
- ANCOVA analysis to detect the differences between the experimental group and the control group in the post scale.

Equivalence between the two groups

To confirm the equivalence of the two groups on the pre scale, (two-way ANOVA) has been applied to detect the differences between the control group and the experimental group with regards to the pre-scale.

Table-3: Results of the (two-way ANOVA) to detect the differences according to the variables of the group and gender in the pre scale

source of variation	total squares	degrees of freedom	average squares	(F) value	statistical significance
Group	0.417	1	0.417	0.060	0.808
Gender	0.017	1	0.017	0.002	0.961
Error	397.750	57	6.978		
Total rater	398.183	59			

Table-3 shows no statistically significant differences at the significance level (0.05) for the group variable on the pre-scale where the (F) value was (0.060) by a statistical significance of (0.808), and no statistically significant differences at the significance level (0.05) for the variable of gender on the pre scale where the value of (F) was (0.002) by a statistical significance of (0.961), so there is an equivalence between the two groups in the pre-scale.

Discussion of the Study Results

Here are the results of the study and its discussion according to its hypotheses:

Null hypothesis: There is an impact for the (K.W.L) on the acquisition of the scientific concepts in science of the third-grade students in the directorate of education

of Irbid due to the variable of gender (males and females) and the group.

Alternative hypothesis: There is no impact for the (K.W.L) on the acquisition of scientific concepts in the science of the third-grade students in the directorate of education of Irbid due to gender (males and females) and the group.

To test these hypotheses, the arithmetic means of the pre-scale and the post-scale were extracted according to the variables of the group and gender in addition to the modified means and (ANCOVA) to detect the differences between the experimental group and the control group in the post-scale with the presence of the pre-scale. Here are the results.

Table-4: Arithmetic means and standard deviations of the pre and post scales and the adjusted arithmetic means according to the variables of group and gender

Group	gender	pre scales		post scales		Modified arithmetic mean
		Arithmetic mean	standard deviation	Arithmetic mean	standard deviation	
control	males	10.53	2.07	15.33	1.72	12.93
	Females	11.07	2.43	19.07	1.22	15.07
	Total	10.80	2.23	17.20	2.40	14
Experimental	males	10.93	2.40	18.13	1.60	14.53
	Females	10.33	3.48	19.73	.46	15.03
	Total	10.63	2.95	18.93	1.41	14.87

* Arithmetic mean of 20 degrees.

Table-3 shows virtual differences between the pre-scale and the post-scale for the experimental group and the control group where the arithmetic means of the males and females in the pre test of the control group were 10.53 and 11.07, respectively, and the arithmetic means of the same gender arrangement in the experimental group were 10.93 and 10.33, respectively.

The arithmetic means for both males and females in the post-test of the control group were 15.33 and 19.07 and 18.13 for males and 19.73 for females in the experimental group.

To detect the statistical significance of these differences, (ANCOVA) was extracted in addition to the size effect through the (Eta Square); table (5) illustrates this.

Table-5: The results of (ANCOVA) to detect differences between the experimental and control groups in the post-test with the presence of the pre- scale and the (ETA)

Source of variation	total squares	degrees of freedom	average squares	(F) value	statistical significance)Eta(
Group	38.046	1	38.046	17.404	0.000	0.524
Gender	113.620	1	113.620	51.973	0.000	0.732
Pre-scale	17.437	11	1.585	0.725	0.709	0.34
Error	100.563	46	2.186			
Total rater	269.733	59				

Table-5 shows:

- There are statistically significant differences at the level of significance (0.05) for the variable of the group in the post scale where the (F) value was (17.403) by a statistical significance of (0.000) and the differences were in favor of the experimental group where the modified arithmetic mean was (14.87), while the arithmetic mean of the control group was (14) and the Eta Square was (52.4%). This impact is attributed to using the (K.W.L) in teaching science for the students of the experimental group, which is due to the impact of the (K.W.L) on developing the thinking skills of the students of the experimental group and helping students connect the meanings of scientific concepts with the cognitive content; this is positively reflected on their understanding and acquisition to such concepts. Furthermore, the (K.W.L) encourages the active learning of the student and his order of thoughts in an organized method helping learners realize the relations among such concepts finding the acquisition of new information and remembrance of prior information easier; however, the students of the control group were taught through the regular method which focused on memorizing the scientific concepts

without understanding them. Furthermore, through the (K.W.L), the right and left halves of the brain are used combining the knowledge information, images, and shapes. This result is consistent with all the mentioned studies such as [15, 17]. This study was not inconsistent with any study, which shows the effectiveness of the (K.W.L).

- There are statistically significant differences at the level of significance (0.05) for the variable of gender in the post scale, where the (F) value was (51.973) by a statistical significance of (0.000) and the differences were in favor of the females' group; the arithmetic mean was (19.73), while the arithmetic mean for the males in the experimental group was (18.13) and the mean of the control group for the females was (19.07) and the males was (15.33); the Eta Square was (73.2%). The researcher attributes this result to the fact that the female students are exposed to an educational environment that is more disciplined in terms of the classroom environment and teaching methods, especially in classes taught by female teachers where the educational environment in which the female students learn is less punitive and more enthusiastic; however, the male students are exposed to a less disciplined and less enthusiastic

educational environment, especially if education is done by a male teacher since they face penalties that are more severe than those of the female students. Furthermore, follow-up and the organization of the job differ between the males and females since there is more attention and focus on follow up and organized work when dealing with the female students. Another reason might be the competitiveness among the males and females leading to raising the level among the females and their motivation towards learning. No prior study dealt with the variable of gender.

RECOMMENDATIONS

- Employing the K.W.L in teaching science.
- Conducting further studies on other educational levels.
- Preparing training courses for male and female teachers at all educational levels on the K.W.L strategy which was proven effective; it was recently adopted in Jordan.
- Encouraging the male and female science teachers and teachers of the first three grades to try the strategy in several activities and creating various methods in using it in a way that suits the educational stage.

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